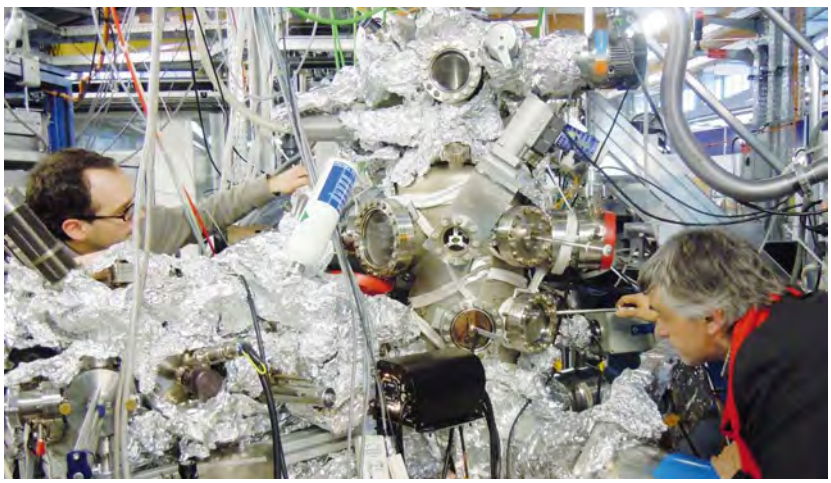
PHOTOVOLTAICS

TEMPO counts **on solar energy**

As the basic elements of solar panels, photovoltaic cells are electronic components that generate electricity when exposed to sunlight. Until now they were usually made of silicon semiconductors, but new generations of photovoltaic cells are now being studied, notably under TEMPO beamline X-rays



Mathieu Silly (on the left) and Fausto Sirotti (on the right) making soft X-ray photoelectron spectroscopy experiments on TEMPO.

"Classic" silicon photovoltaic cells produce a good yield (12-20%), but their cost is high and there is a risk that the basic material will run out. New hope has come from the development of organic photovoltaic cells based on polymers, which are less costly, both financially and in the energy required to manufacture them, and are biodegradable, flexible and lightweight. Unfortunately, their performance is poor (2-5%) because they do not absorb solar radiation efficiently in the low energy range (red and infrared) and they are unstable in the long term.
The inclusion of nanoparticles that absorb radiation in the near infrared would offset the disadvantage of the lack of sensitivity in this part of the solar spectrum. W. Flavell and her group (Manchester University) carried out experiments related to this on the TEMPO beamline in order to study the electronic structure of nanoparticles of lead sulfide (PbS) by soft X-ray photoelectron spectroscopy. The study aimed to correlate the electronic properties with the sizes of nanoparticles to ultimately control their sizes in order to optimize the extraction of energy from the solar spectrum throughout its range, from red to ultraviolet.
Studies are also underway to directly observe the phenomena of photon absorption by photovoltaic cells, through measurements combining synchrotron radiation and laser pulses.

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Three items of information on photovoltaics

1 The conversion of light into electricity, or the photovoltaic effect, was discovered by Antoine Becquerel in 1839. It was not until nearly a century later that scientists understood and exploited this physical phenomenon.

2 The main electronic property studied in the work cited above is the width of the "energy gap", on which depends the material's ability to conduct electricity. In conductive materials, this width is zero.

3 Standard methods of synthesizing PbS nanoparticles involve solvents or other highly toxic reagents. These researchers were interested in a new form of synthesis that was "greener" than its predecessors, the solvent being olive oil!

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